WF4313/6413-Fisheries Management

Class 7

In the news & annoucements

Refining Crappie (*Pomoxis spp.)* Aquaculture Techniques

Christian Shirley, M.S. candidate

Thesis seminar

Department of Wildlife, Fisheries and Aquaculture

September 26, 2018 12:30 p.m.

Tully Auditorium


EXAM
SEASON
POWERADE


MANAGEMENT APPLICATION
FISHLESS MOUNTAIN LAKES

The problem

Fishless mountain lakes can potentially serve a unique recreational fishing opportunity, but the growing season is limited in these lakes and therefore fish stocked into these systems need to grow fast to provide quality fishing experiences.

Decision Making Process

1. Problem
2. Objectives
3. Alternatives
4. Consequences & tradeoffs
5. Select best option between alternatives

HISTORICALLY FISH WERE STOCKED BY MULE & HORSE

Management objectives

1. Provide fishing opportunities in otherwise fishless locations
2. Provide good size structure in systems with short growing season
3. Minimize environmental consequences
4. Minimize cost
5. Others…

Management alternatives

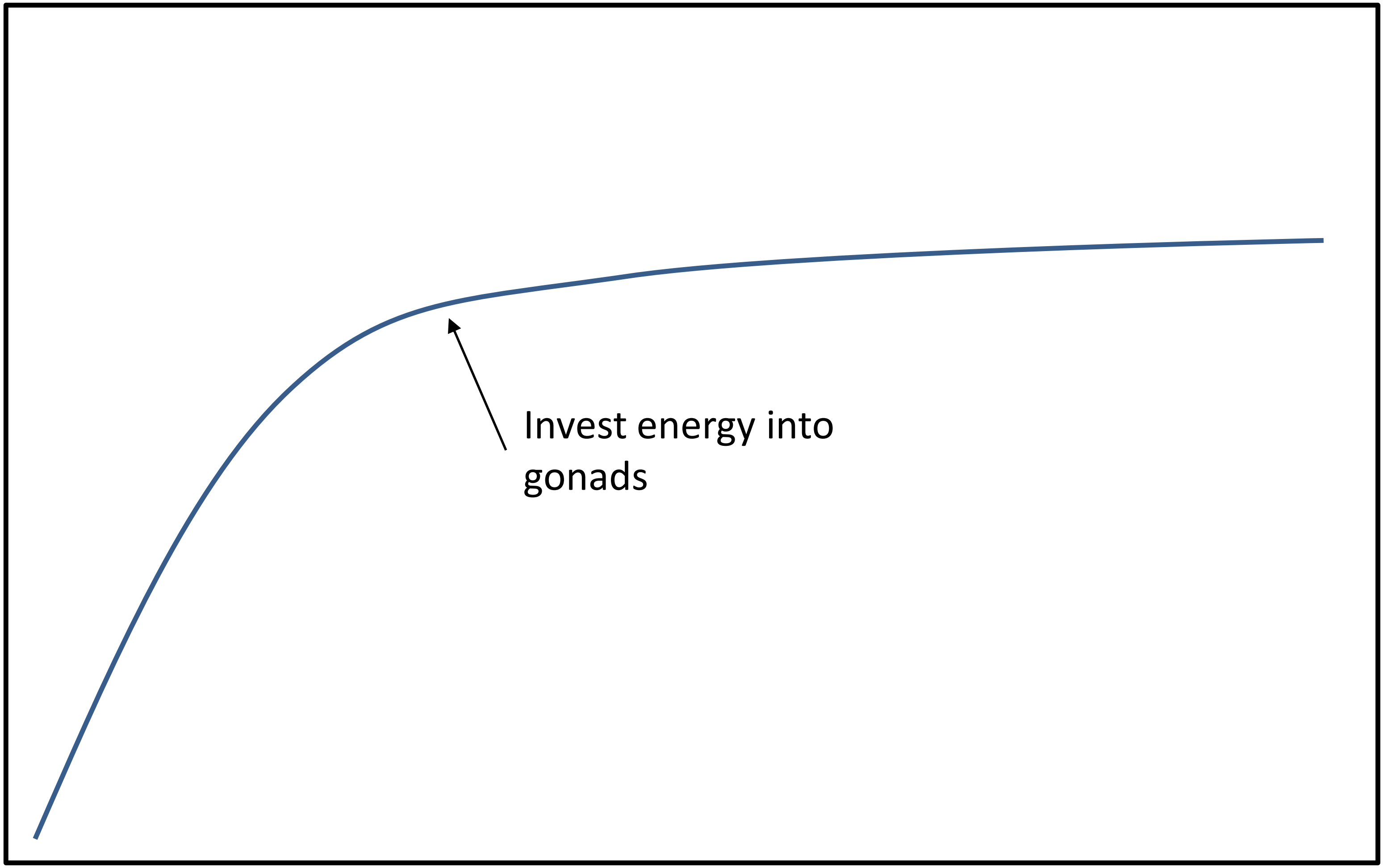
1. Stock Gerrard strain rainbow trout into the systems
2. Stock Gerrard strain triploid rainbow trout into the systems
3. Others??

Gerrard strain rainbow trout that are adapted to cold, short growing seasons.

	Stock Kamloops strain rainbow trout into the systems	Stock Kamloops strain triploid rainbow trout into the systems
1. Provide fishing opportunities in otherwise fishless locations	3	3
2. Provide good size structure in systems with short growing season	**2**	**3** **expected from theory**
3. Minimize environmental consequences	1	3 Sterile fish
4. Minimize cost	3	2 More expensive to make triploid trout
Total	**9**	**11**

Score 1-3 & Rank the ability of a management action to achieve objectives

What do you mean expected from theory?



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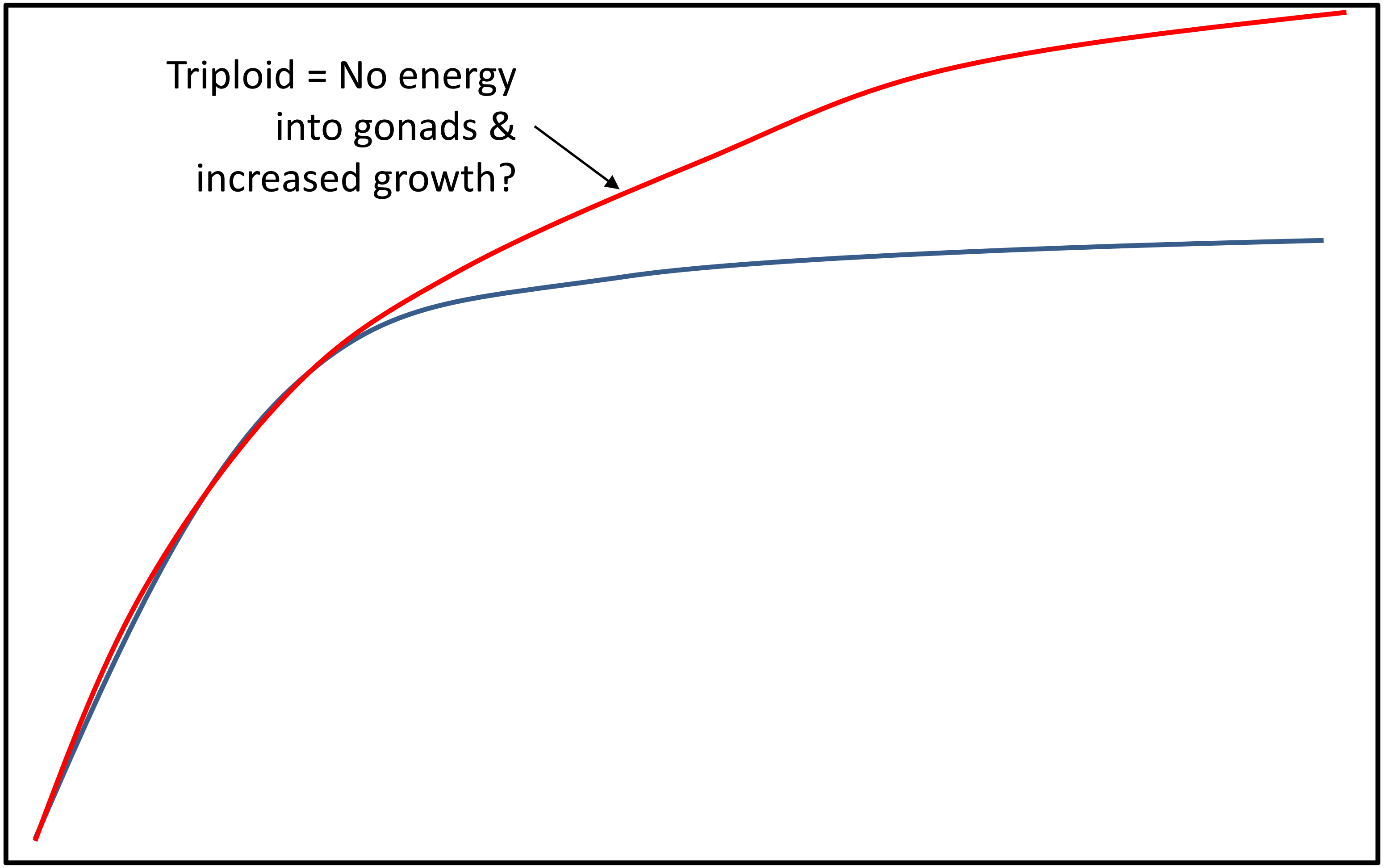

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ARTICLE

Performance of Diploid and Triploid Rainbow Trout Stocked in Idaho Alpine Lakes

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Abstract

Increased growth, improved survival, and genetic protection of wild stocks have been suggested as benefits of stocking triploid (i.e., sterile) salmonids for recreational fisheries. We examined the return rates and growth of mixed-sex diploid (2N), mixed-sex triploid (3N), and all-female triploid (AF3N) rainbow trout *Oncorhynchus mykiss* across 28 alpine lakes. Equal numbers of each treatment group were stocked in 2001 and 2003 and sampled 3–4 years later. During 2004 and 2005, a total of 75 2N and 36 3N marked rainbow trout were recaptured. Taken together, the 2N fish accounted for an average of 0.68 of the total marked fish caught, and the combined proportions of test fish (including netting and angling) differed significantly between the test groups and were consistent across survey years. During 2006 and 2007, a total of 60 2N, 31 3N, and 208 AF3N marked rainbow trout were recaptured. The mean length of the test fish was similar between test groups within sampling years. Overall, the return of 3N rainbow trout to alpine lakes in Idaho was low compared with that of 2N trout, whereas AF3N trout appeared to return in higher proportions than both of the other groups. The triploid stocks studied in this evaluation did not show any growth advantages over the duration of the study. Study design limitations may have contributed in part to some of the differences in the number of 2N and 3N rainbow trout captured. However, our results suggest that fisheries managers should consider all-female triploid rainbow trout as a low-risk option for maintaining alpine lake fisheries while minimizing the impact on native stocks.

Do triploid fish grow better?

TABLE 5. Total lengths (mm) and weights (g) of marked diploid (2N), triploid (3N), and all-female triploid (AF3N) rainbow trout recaptured in Idaho alpine lakes, by sampling year. Within sample years, stocks with the same letter are not statistically different.

			Length		Weight	
Stocking year	Stock	n	Mean	(SD)	Mean	(SD)
		2004 Sample				
2001	2N	56	332 z	(39)	376 z	(133)
	3N	29	322 z	(23)	305 y	(73)
		2005 Sample				
	2N	19	348 z	(62)	464 z	(253)
	3N	7	327 z	(46)	351 z	(143)
		2006 Sample				
2003	AF3N	157	295 z	(35)	275 z	(88)
	2N	43[a]	290 z	(31)	274 z	(85)
	3N	19	280 z	(35)	233 z	(83)
		2007 Sample				
	AF3N	50	336 z	(31)	357 z	(107)
	2N	11	340 z	(39)	391 z	(162)
	3N	12	321 z	(28)	338 z	(100)

[a]While 49 2N fish were captured, only 43 were actually measured.

No difference

Take home: Diploid (2N) and triploid fish (3N) did not grow any better.

No growth advantage of triploidy.

	Stock Gerrard strain rainbow trout into the systems	**Stock Gerrard strain triploid rainbow trout into the systems**
1. Provide fishing opportunities in otherwise fishless locations	3	3
2. Provide good size structure in systems with short growing season	**2**	**2 ~~3~~** ~~**expected from theory**~~
3. Minimize environmental consequences	1	3 Sterile fish
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Total	**9**	**10**

Score 1-3 & Rank the ability of a management action to achieve objectives

Decision Making Process

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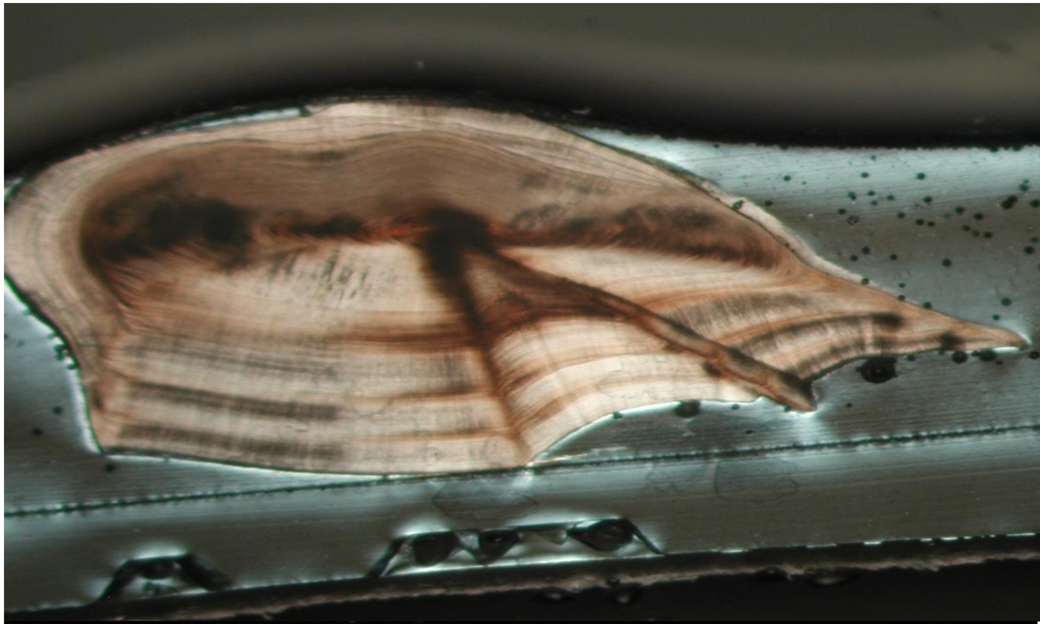
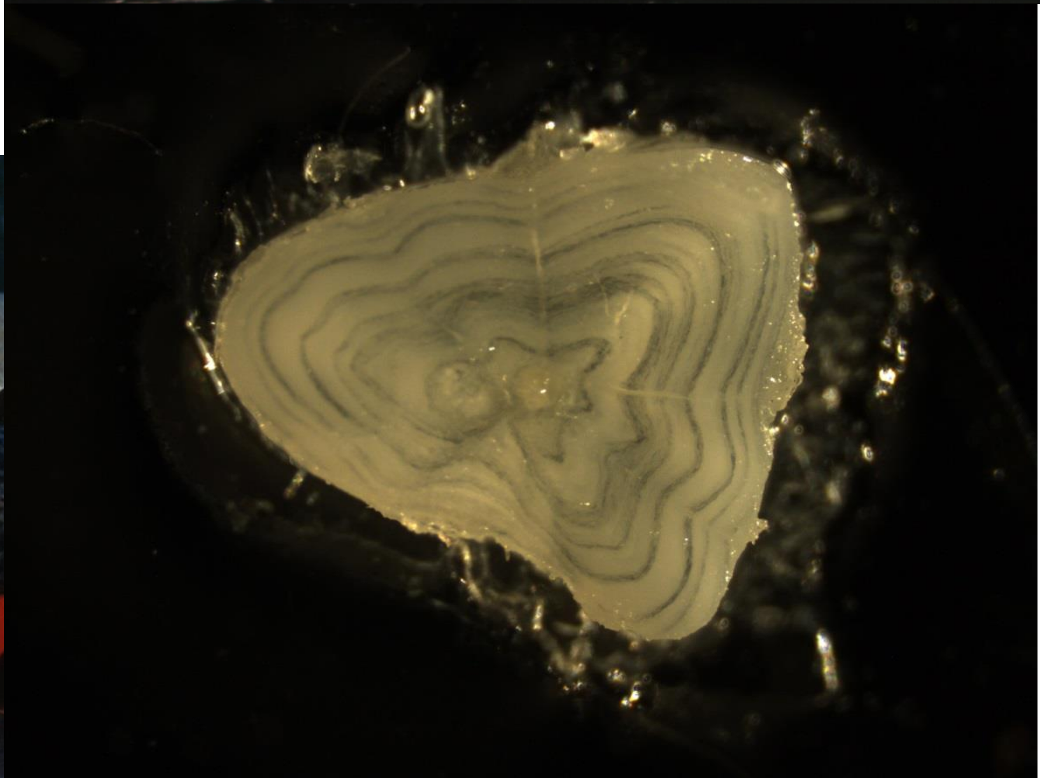
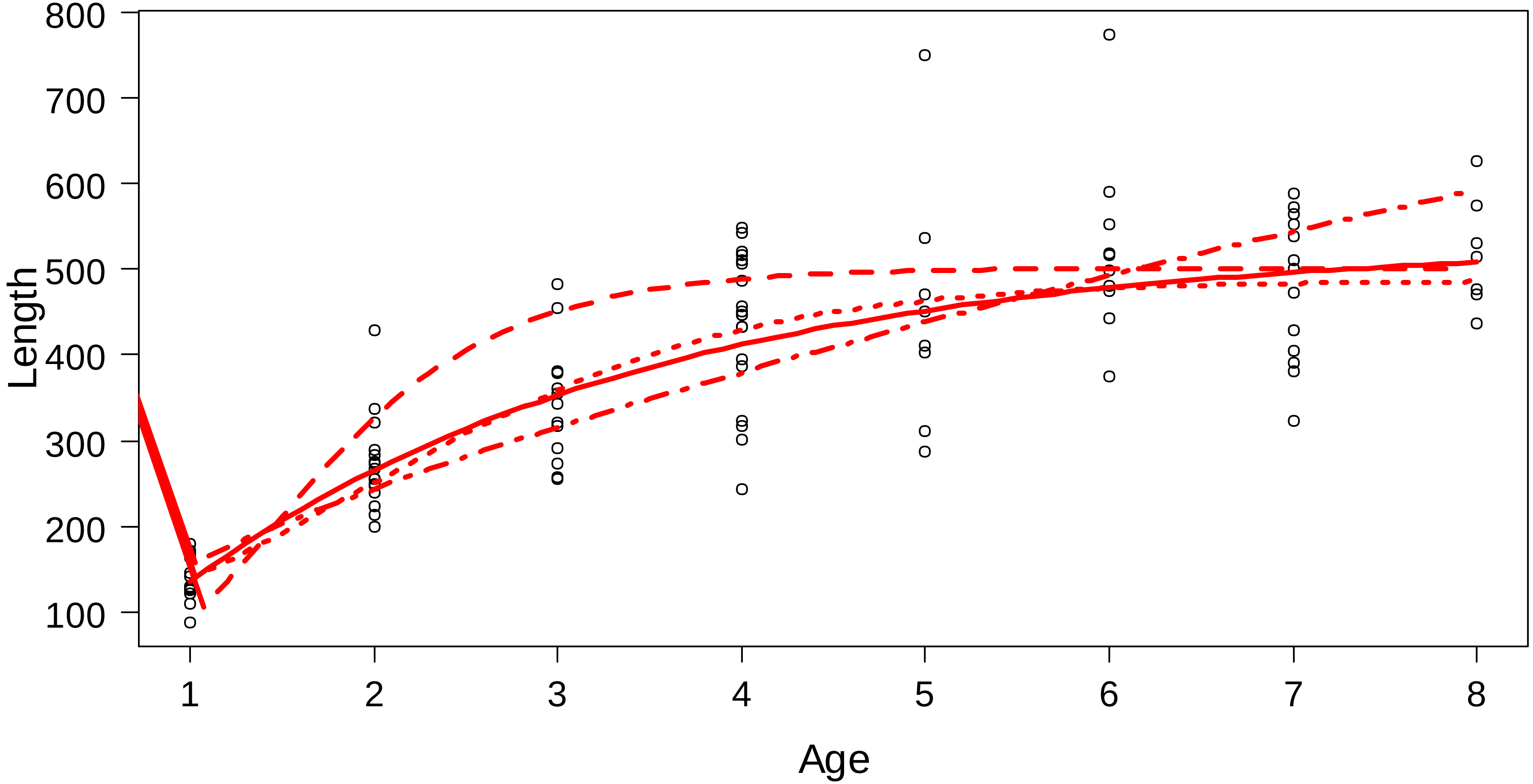
WHERE WE LEFT OFF

Age & Growth

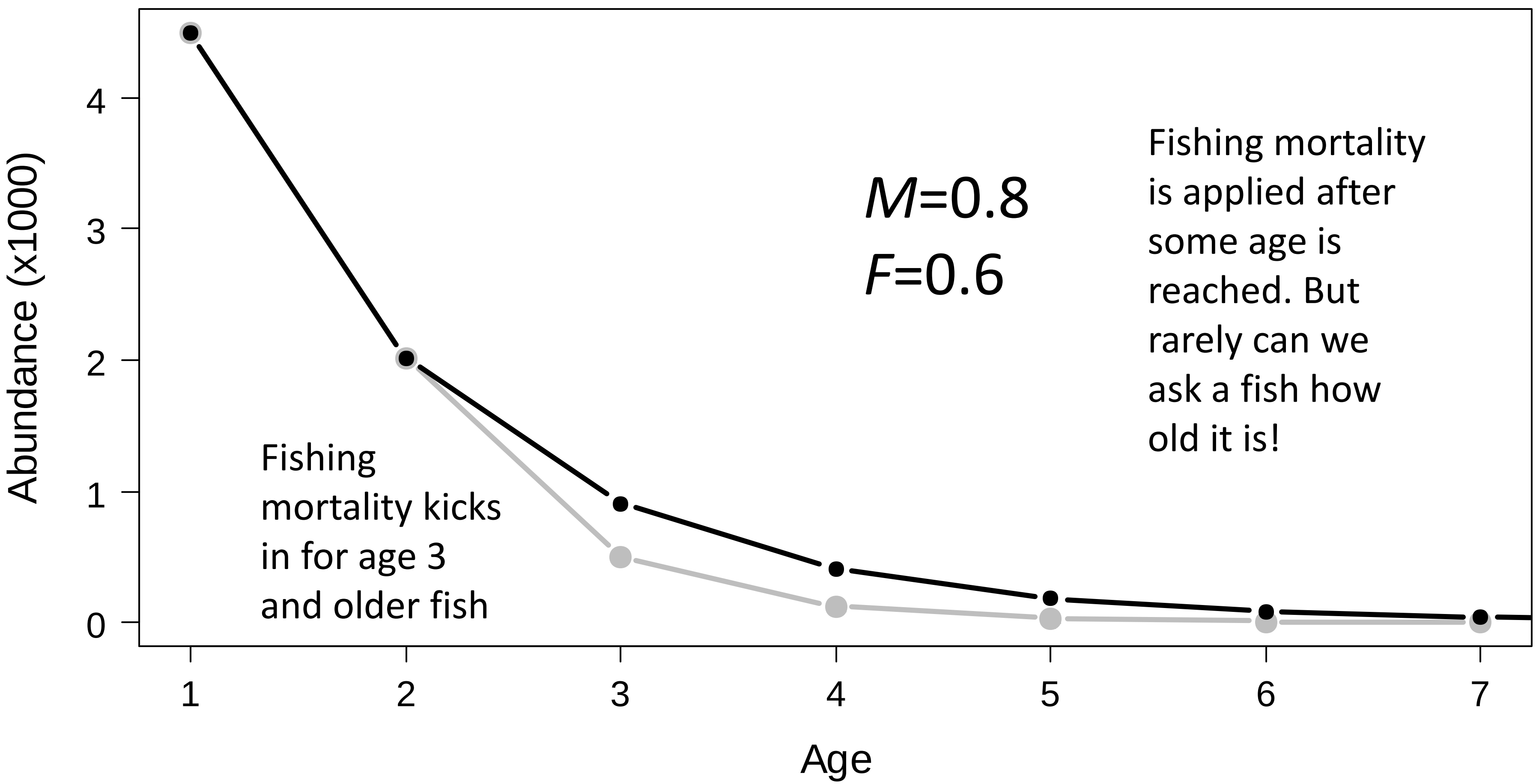




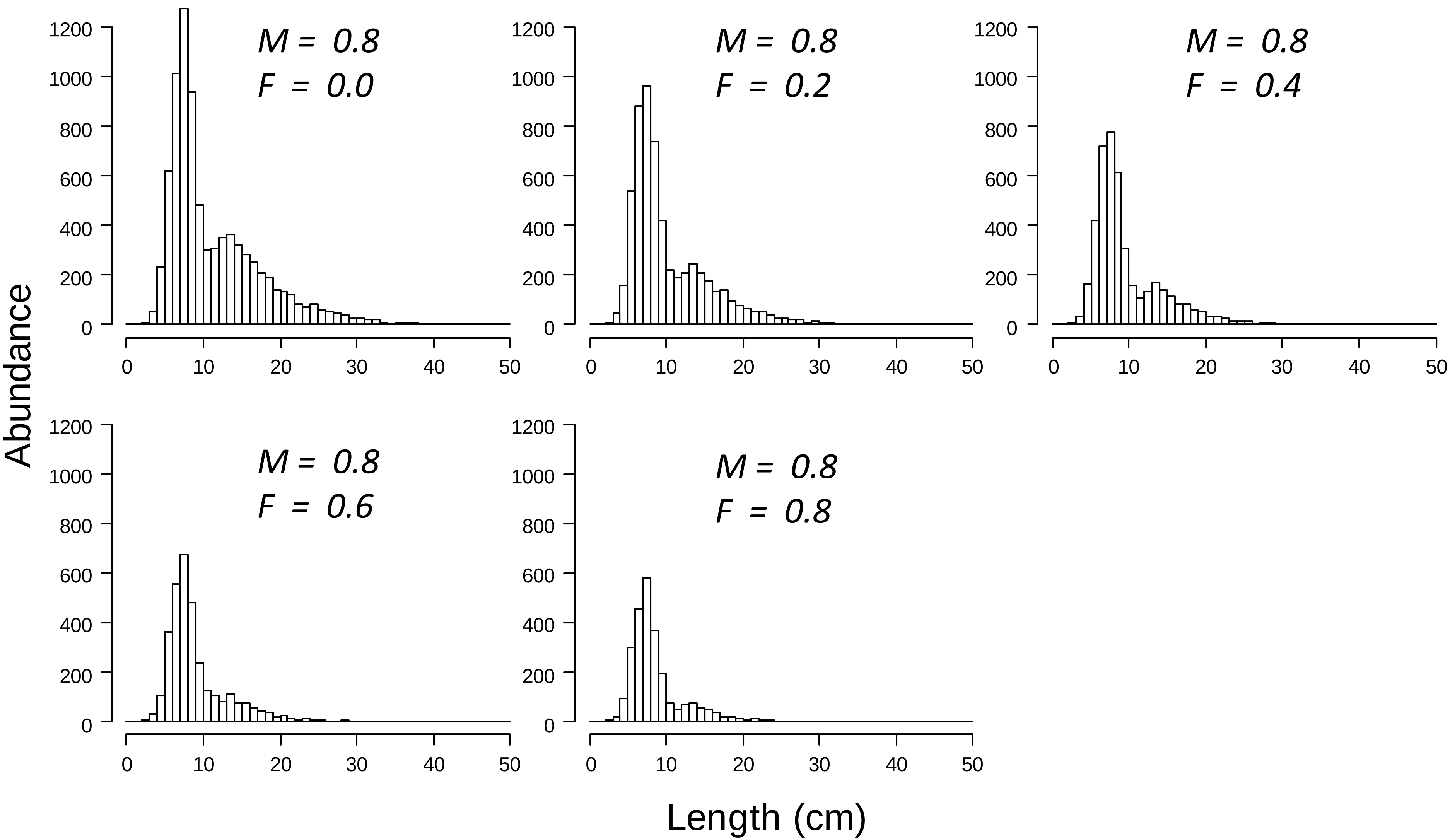
Growth Models

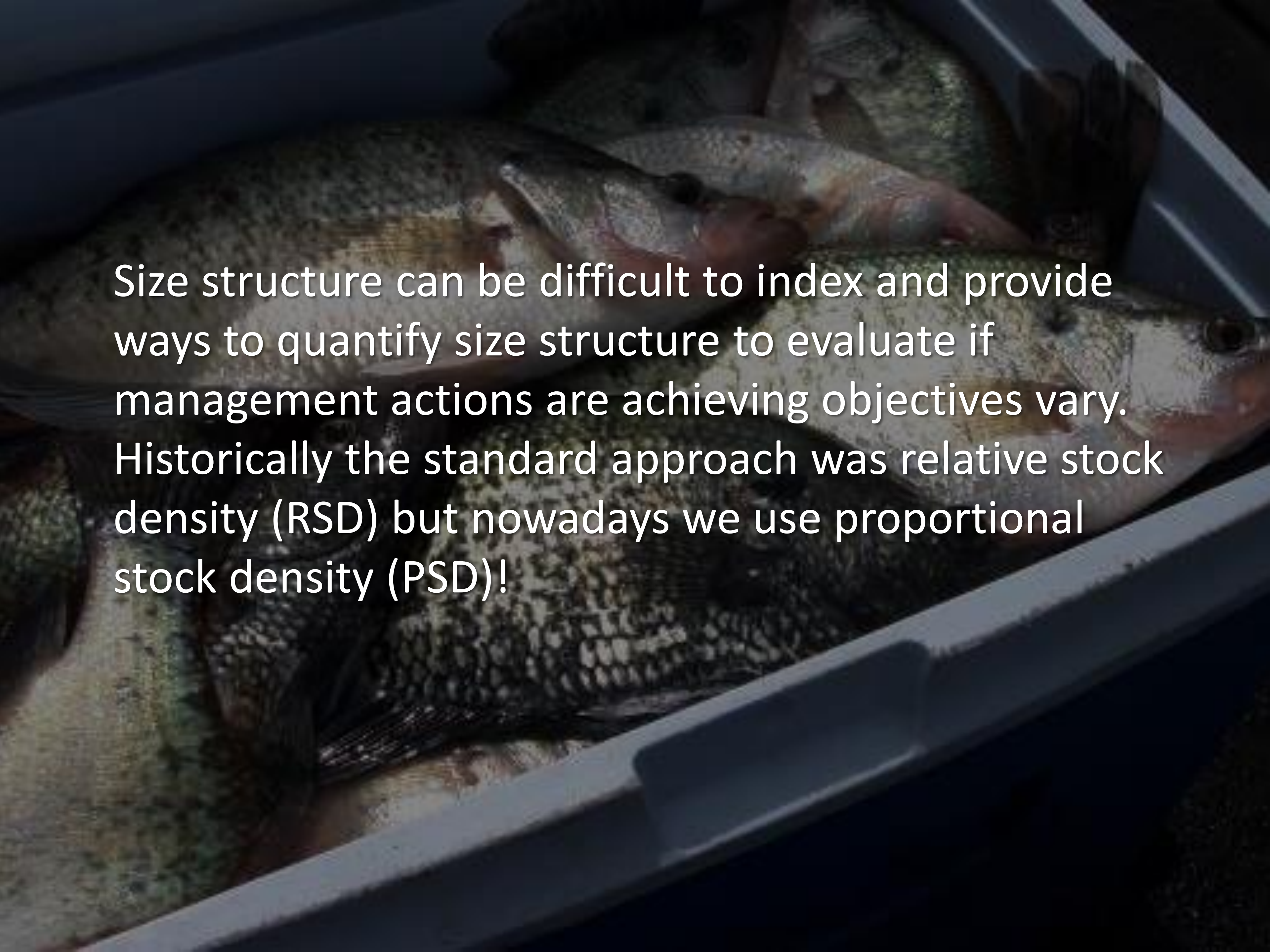


Effect of fishing



Size structure results from age structure





Size structure can be difficult to index and provide ways to quantify size structure to evaluate if management actions are achieving objectives vary. Historically the standard approach was relative stock density (RSD) but nowadays we use proportional stock density (PSD)!

Relative stock density (RSD)

$$RSD = \frac{\text{Number of fish} \geq \text{ quality length}}{\text{Number of fish } \geq \text{ stock length}} \cdot 100$$

Where

- Stock length fish = 8 inches
- Quality length fish = 12 inches

Originally developed for largemouth bass

Adjusting stock and quality lengths

Anderson and Weithman (1978)

- Defined stock and quality lengths as percentages of all-tackle world record lengths
- Suggested stock and quality lengths for 26 species

Relative stock density

$$RSD = \frac{\text{Number of fish} \geq \text{ specified length}}{\text{Number of fish } \geq \text{ stock length}} \cdot 100$$

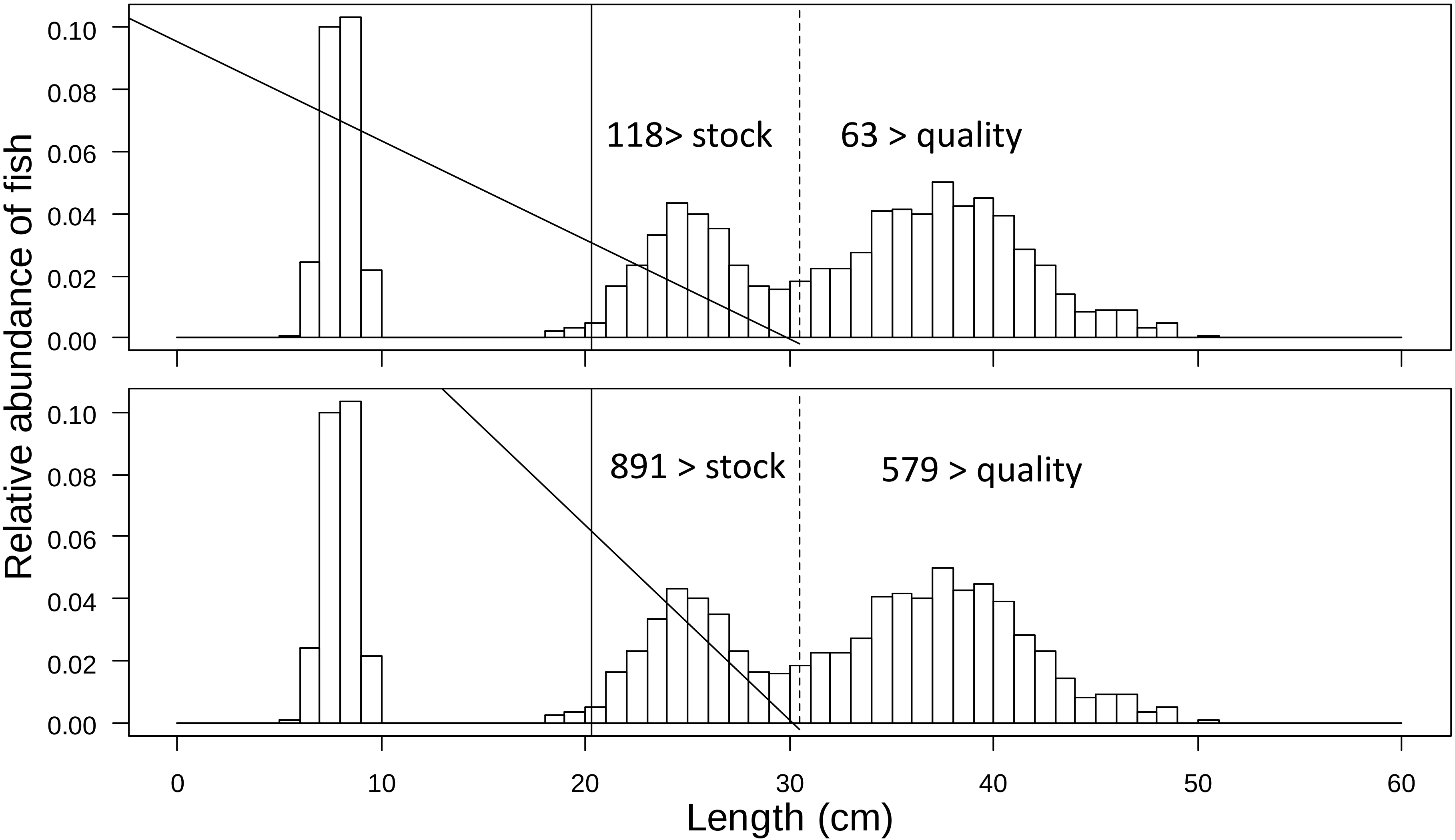
Where a:

- Stock length fish 20-26% of world record
- Quality length fish 36-41% of world record
- **<u>Or any other specified length (e.g., 15 inches)</u>**

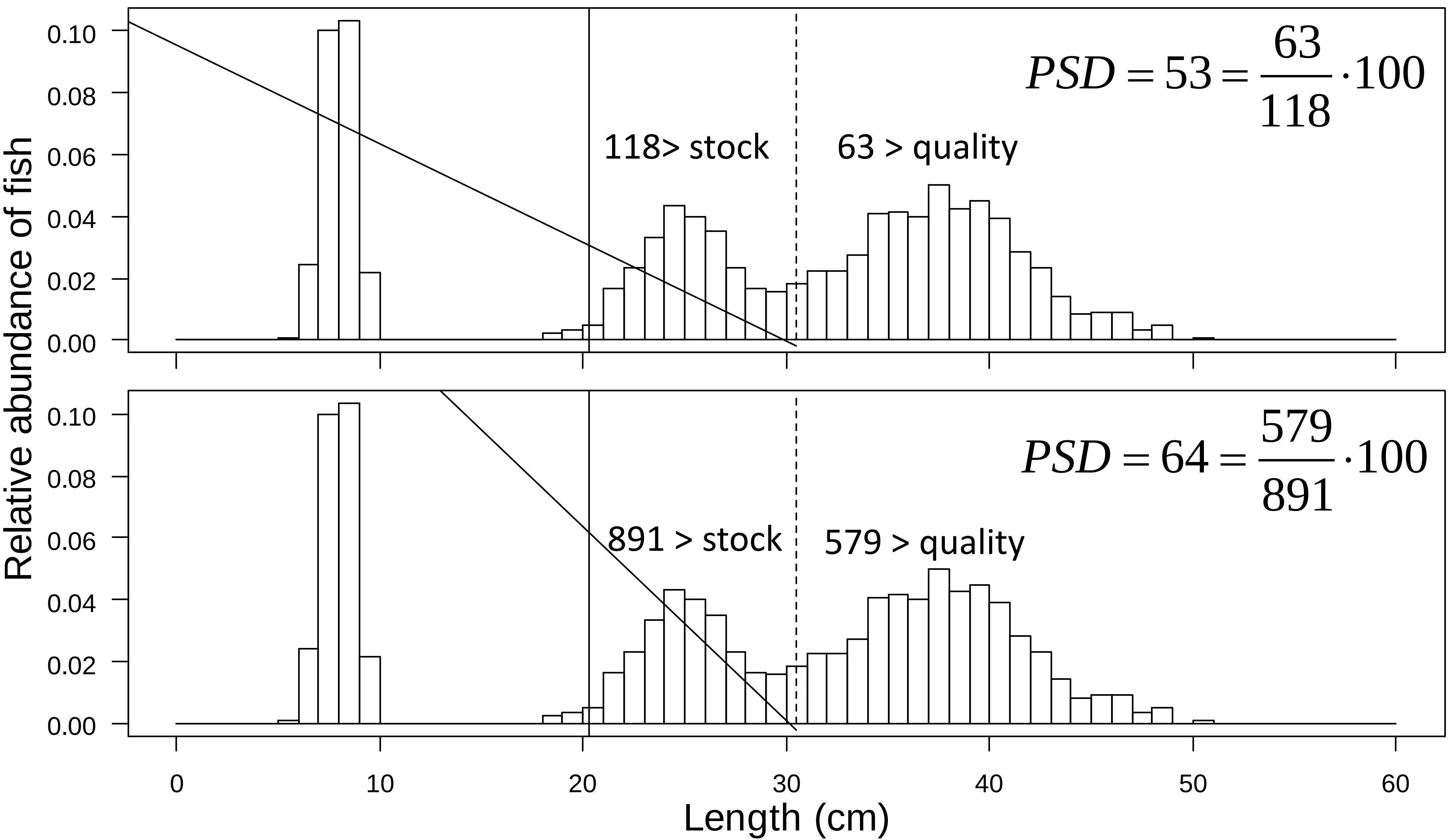
$$RSD-15 = 30 = \frac{30}{100} \cdot 100 = \frac{\text{Number of fish} \geq 15\,\text{inches}}{\text{Number of stock fish}} \cdot 100$$

- 30 fish greater than 15 inches
- 100 fish that were stock size or greater

Stock and quality largemouth bass



Largemouth bass PSD



Interpreting PSD

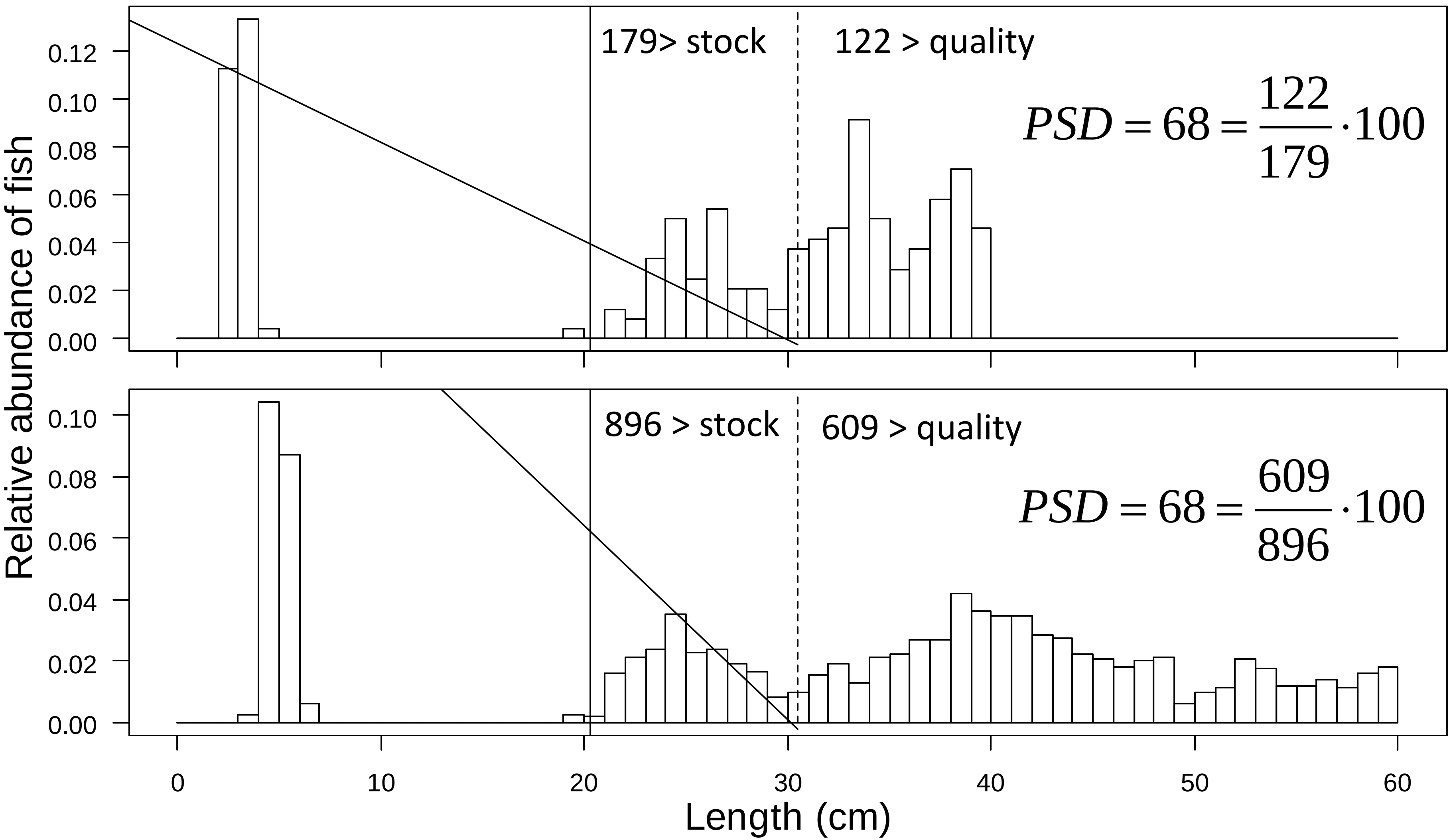
$$PSD = 53 = \frac{63}{118} \cdot 100$$

- 53% of stock size fish are quality size

$$PSD = 64 = \frac{579}{891} \cdot 100$$

- 64% of stock size fish are quality size

Issues?



179> stock
122 > quality
$PSD = 68 = \frac{122}{179} \cdot 100$
896 > stock
609 > quality
$PSD = 68 = \frac{609}{896} \cdot 100$
Relative abundance of fish
Length (cm)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0
10
20
30
40
50
60

Adding length categories

Gabelhouse (1984): need to move beyond a two-cell model of length categorization and further refine PSD by using:

- stock (S)
- quality (Q)
- preferred (P)
- memorable (M)
- trophy (T)

Adding length categories

Gabelhouse (1984): need to move beyond a two-cell model of length categorization and further refine PSD by using:

- stock (S)
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- memorable (M)
- trophy (T)

Calculation of length categories

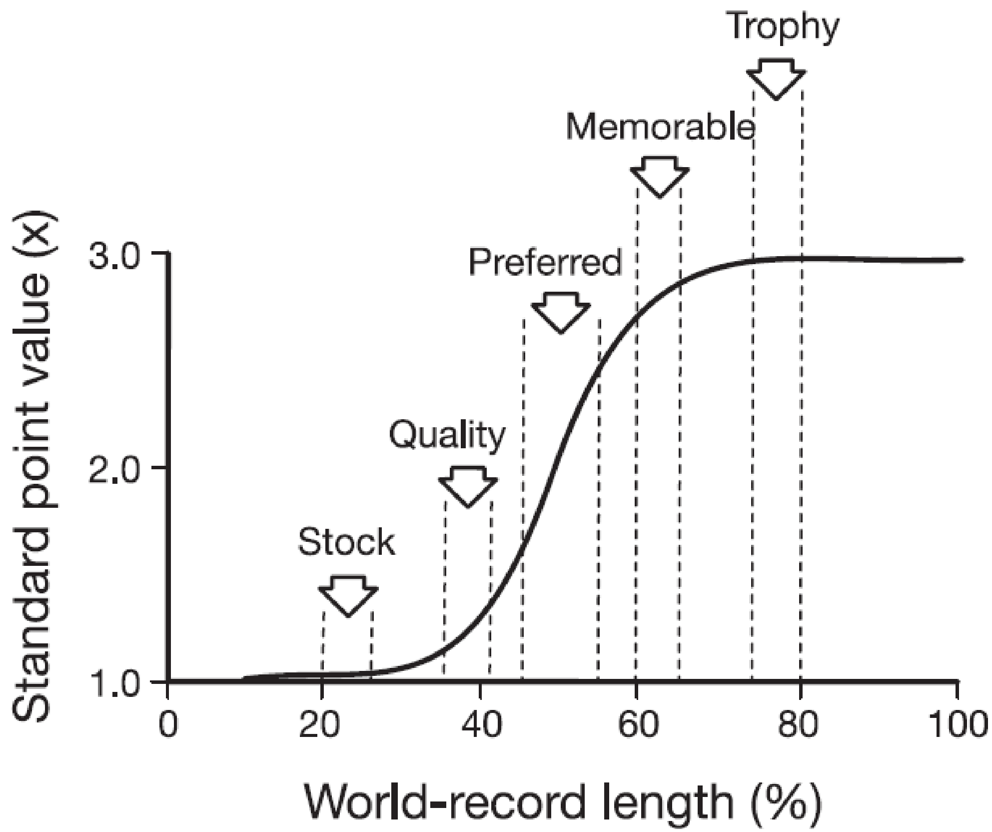
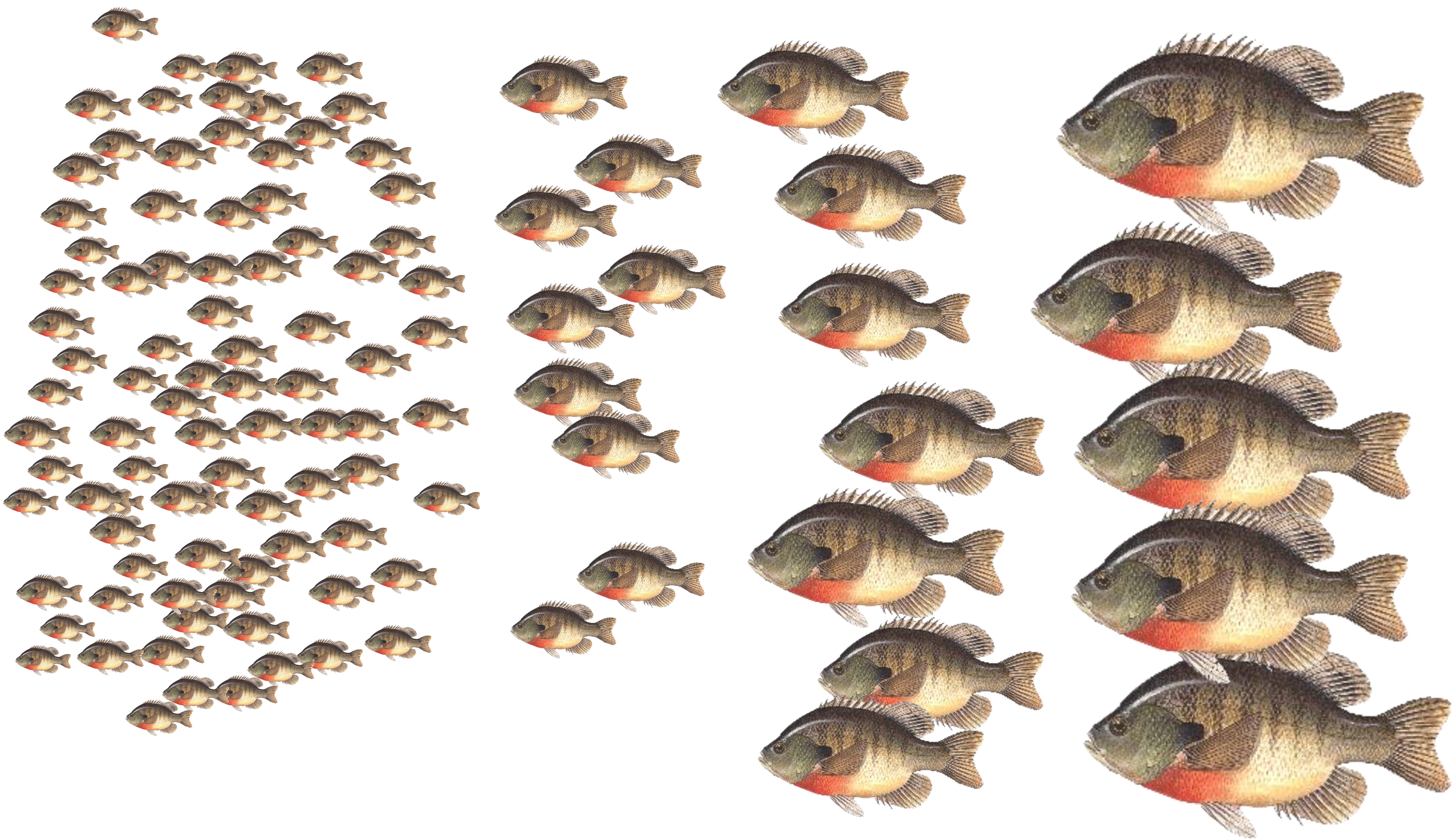


Figure 14.3 Gabelhouse's adoption of Weithman's (1978) fish quality index to identify length ranges from which (or near to which) minimum stock, quality, preferred, memorable, and trophy lengths were selected (from Gabelhouse 1984a).

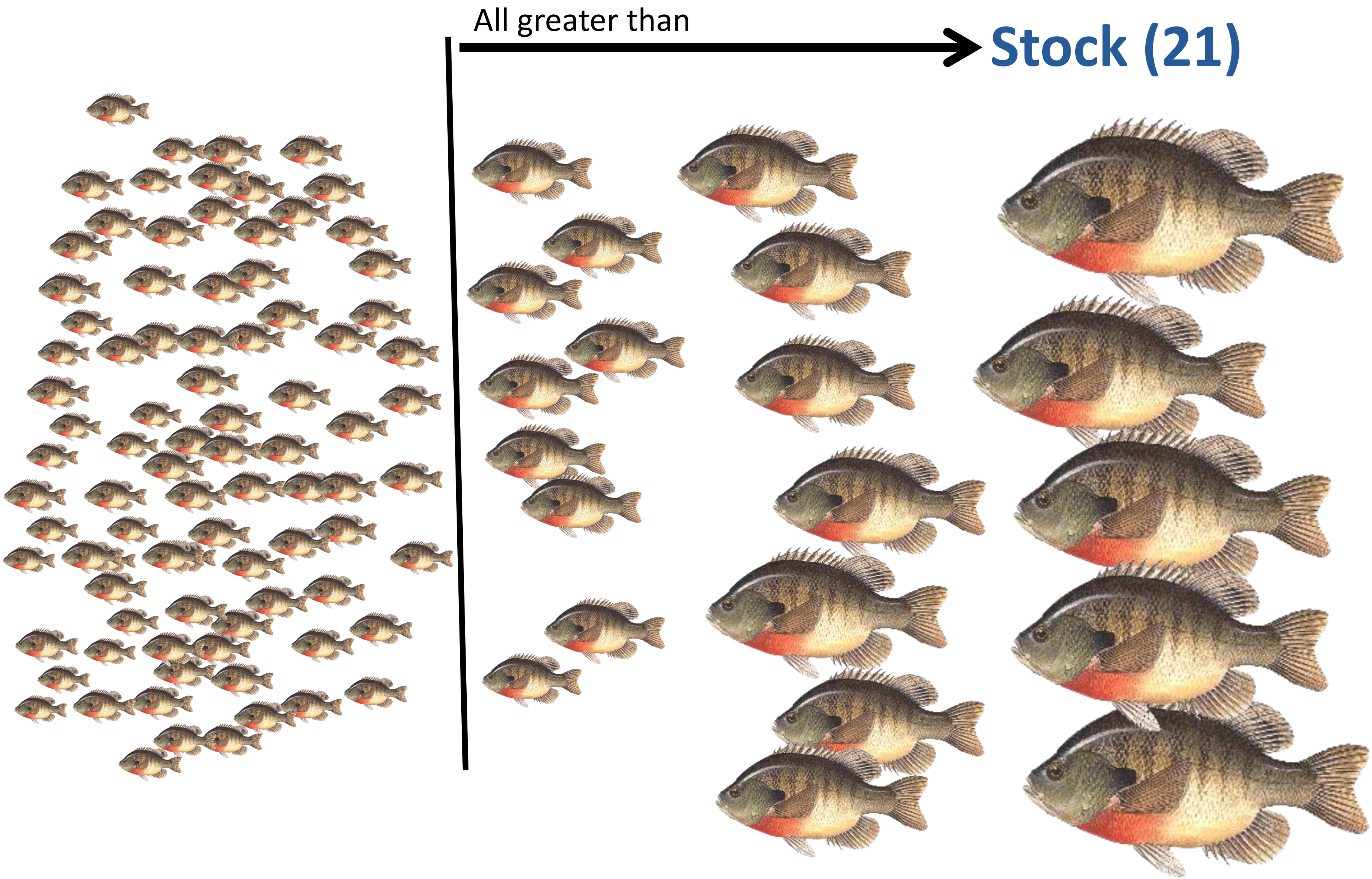
Length categories

Category	Largemouth bass (mm)	Bluegill (mm)
Stock	200	80
Quality	300	150
Preferred	380	200
Memorable	510	250
Trophy	630	300

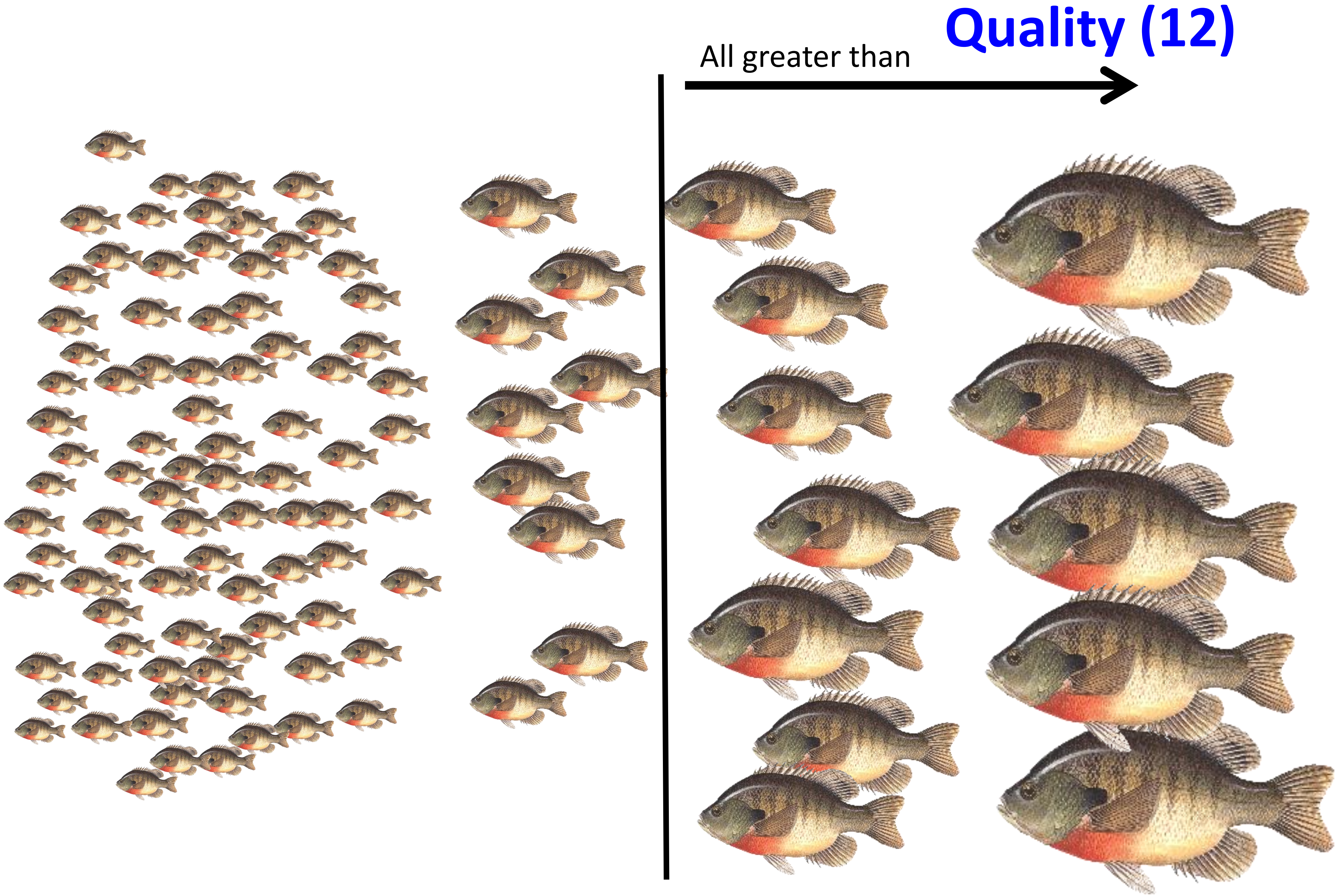
Traditional PSD



Traditional PSD

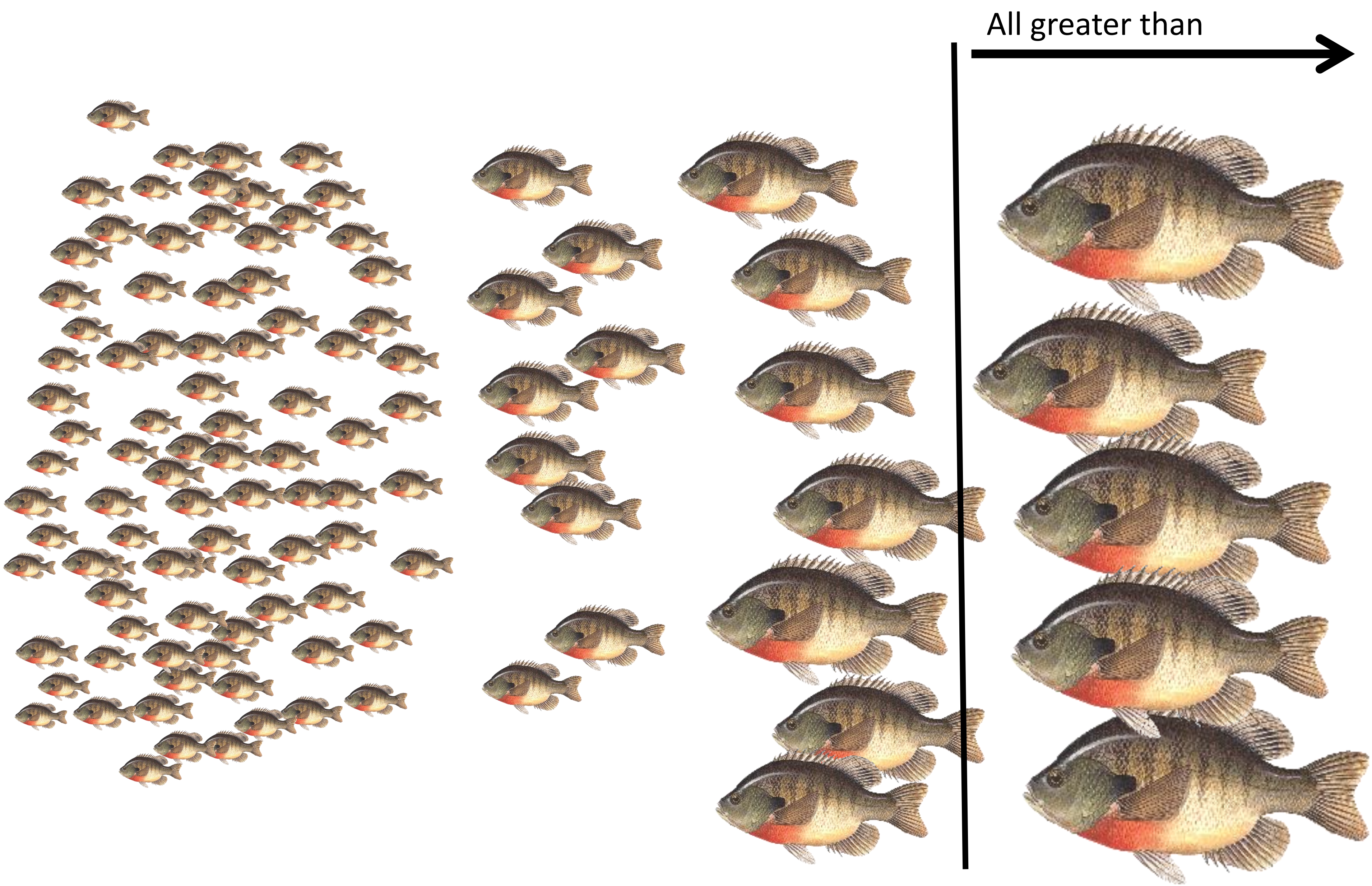


Traditional PSD

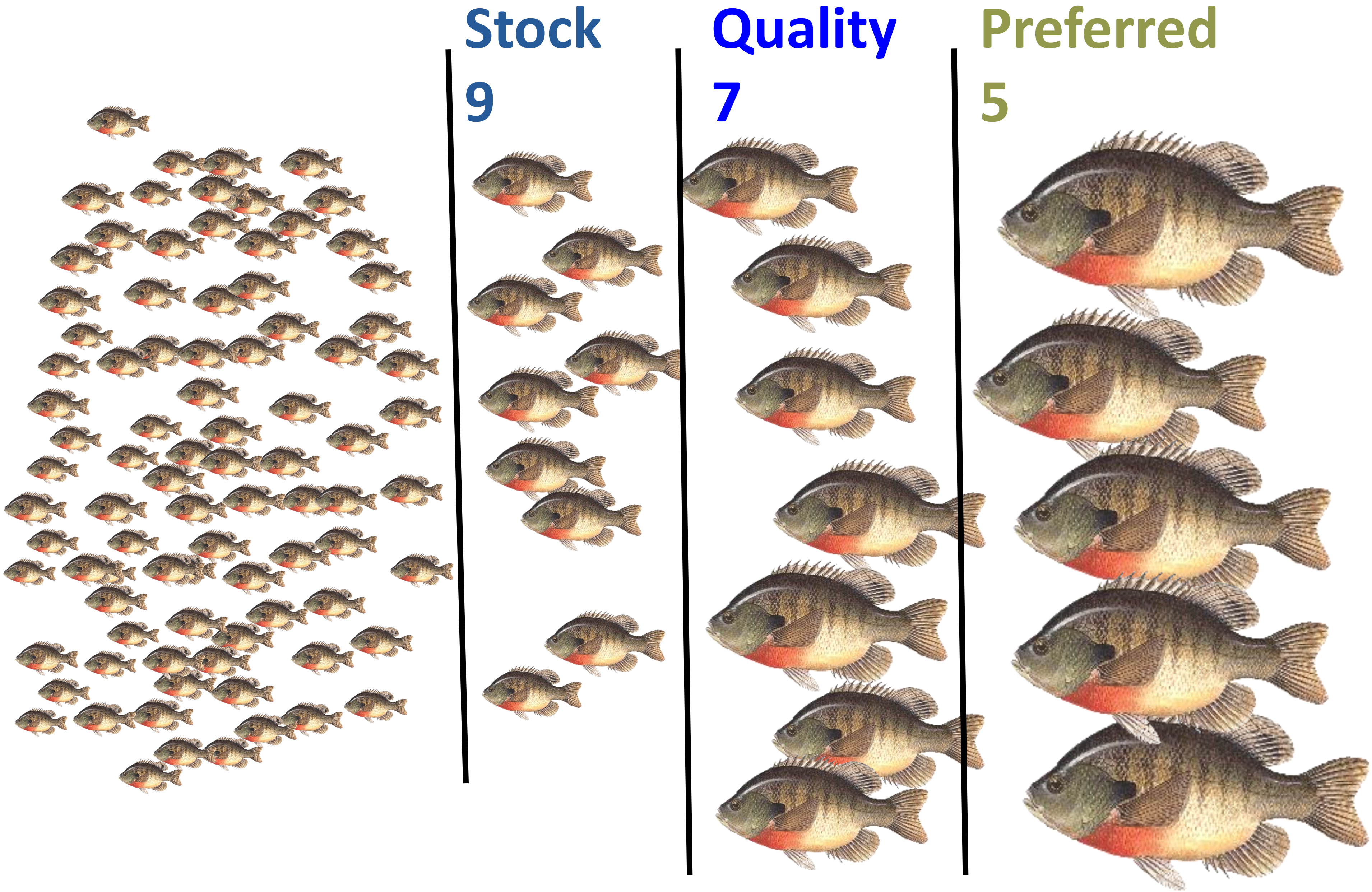


Traditional PSD

Preferred (5)



Incremental PSD



Counts and PSD

Size class	Total	PSD-X	Incremental	PSD-X-Y
Stock	21	100	9	42
Quality	12	57	7	33
Preferred	5	41	5	24

Traditional PSD

$$PSD - X = \frac{\text{Number of fish} \geq \text{ specified length}}{\text{Number of fish } \geq \text{ stock length}} \cdot 100$$

Category	**N**	**Value**
PSD-S	400	100
PSD-Q	100	40
PSD-P	75	25
PSD-M	80	14
PSD-T	10	2

Incremental PSD

$$PSD - X = \frac{\text{Number of fish in bin}}{\text{Number of fish } \geq \text{ stock length}} \cdot 100$$

Category	N	Value
PSD-S-Q	400	60
PSD-Q-P	100	15
PSD-P-M	75	11
PSD-M-T	80	12
PSD-T	10	2

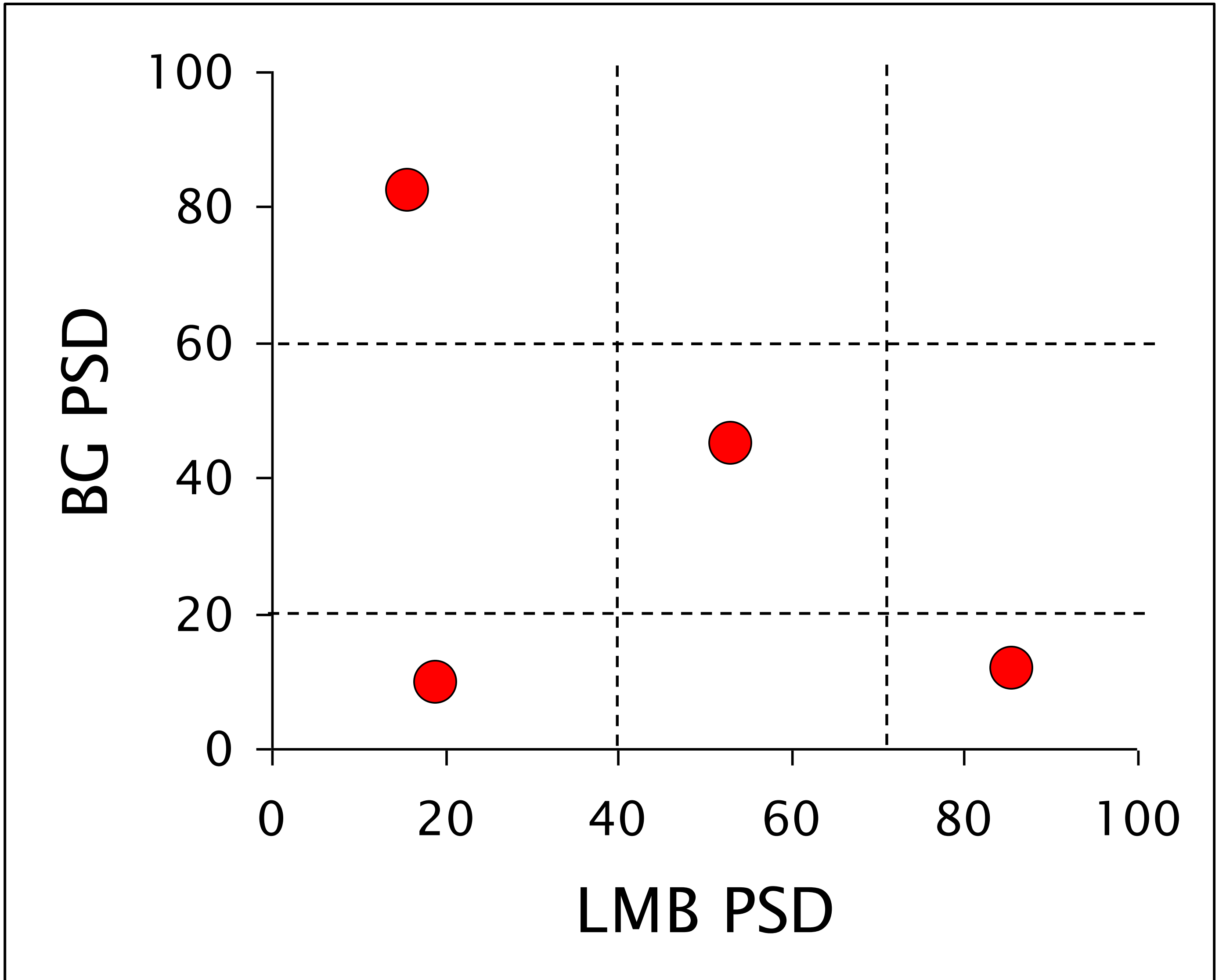
Should sum to 100

Using PSD for management

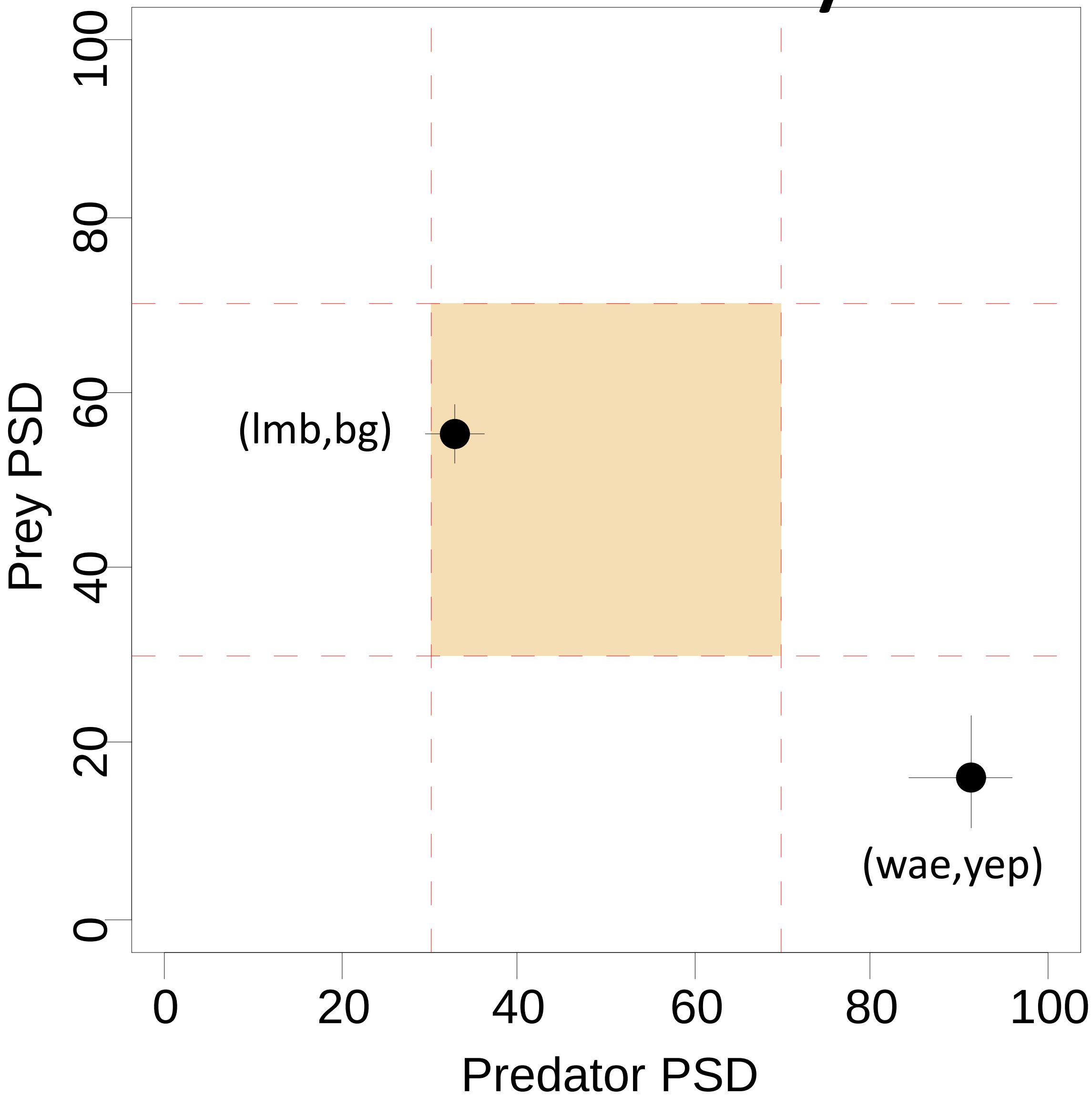
Table 14.4 Proportional size distribution values for largemouth bass and bluegill under three different management strategies described in section 14.3.3 (from Willis et al. 1993).

Management strategy	Largemouth bass			Bluegill	
	PSD	PSD-P	PSD-M	PSD	PSD-P
Panfish	20–40	0–10	0	50–80	10–30
Balanced	40–70	10–40	0–10	20–60	5–20
Big bass	50–80	30–60	10–25	10–50	0–10

Using PSD as an assessment tool:



Predator-Prey



An assessment tool?

- This index *supposedly* gives insight or predictive ability of population dynamics.
- Both high and low values and wide variation in PSD over time are indicative of populations with functional problems such as unstable recruitment, growth, or mortality.

Cautions

- Predicting or drawing conclusions about population dynamics based on the structural indices is not as straightforward in larger waters or in systems with more complex fish communities.
- These systems require stock assessments
- Management decisions should be grounded in other procedures (e.g., relative abundance, recruitment , growth, mortality)